



#### 4. Engineering Data - ~~7~~ - Water Thickener Tank and Mechanism

##### 4.1 General

The water thickener mechanism will be installed by the Purchaser on a steel tank connected to concrete bottom.

##### 4.2 Thickener Design Dimensions

- |    |                              |  |
|----|------------------------------|--|
| a. | Inside Tank Diameter         | 60 feet by 0 inches                          |
| b. | Depth of Straight Side Walls | 13 feet by 0 inches<br>(excluding freeboard) |

##### 4.3 Design Operation Conditions

The thickener equipment furnished under this Specification shall be designed to operate under the following conditions:

- a. 1,800 GPM influent consisting of blast furnace gas scrubber water.
- b. 26,000 ppm suspended solids influent consisting primarily of iron ore particles.
- c. All particles shall be smaller than 100 mesh.
- d. 40 ppm suspended solids effluent (a nonionic, high molecular weight polymer flocculant, Nalco 636 or equal, will be added at the centerwell of the thickener)

##### 4.4 Thickener Mechanism

- a. A double extra heavy duty thickener mechanism, suitable for installation on the Purchaser's concrete foundation shall be designed for continuous operation of 440,000 foot pounds operating torque per standards of the American Gear Manufacturer's Association.
- b. The thickener mechanism shall include the following:
  - 1) A balanced type drive unit consisting of an approximate 50-inches diameter main spur gear of heat treated cast steel hardness, mounted on large diameter precision ball bearings.
  - 2) Two pinions of alloy steel.
  - 3) Two secondary spur gears of heat treated cast steel.
  - 4) Two secondary pinions of alloy steel.

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4.4 Thickener Mechanism (Continued)

## b. (Continued)

- 5) Two aluminum bronze worm gears driven by diametrically opposite hardened steel worms connected by a flexible coupling.
- 6) The balanced worms shall be connected to final reducers driven by two 3 phase, 60 Hertz, 460 volt motors through enclosed rollerchain and sprocket. Contractor shall furnish control schematics for both motors. All motors shall be in accordance with Electrical Data specified herein.
- 7) All thickener beams and support trusses shall be furnished in continuous lengths of steel.
- 8) All gearing components shall be enclosed in a weather-proof housing.

4.5 Overload Alarm

- a. A electrical type drive control overload alarm assembly complete with alarm contacts shall be provided to sound remote alarms, light a red light and stop the mechanism at cut-out torque.
- b. The Contractor shall also furnish, in conjunction with the overload alarm assembly a torque transmitter with two sets of contacts.
- c. All alarm assemblies cut-out switches and transmitters shall be furnished in weather proof assemblies.
- d. Alarms, recorders and remote indicators will be installed and wired by the Purchaser in a Purchaser-furnished control panel in the Water Treatment Building.





## Engineering Data (Continued)

### 4.6 Rake Arms

- a) The long structural arms shall be attached to the lower shaft. The arms shall have sufficient blades properly set and spaced to scrape the settled solids from the entire bottom to the center, two sweeps per full revolution. Mild steel bar stock spikes will be furnished on the rake arm blades and cone scrapers. The arms shall have a slope of 1 3/4 inches per foot.

### 4.7 Discharge Cone

- a) A steel discharge cone 6 foot diameter by 45° slope with a 12 inch flanged discharge connection shall be furnished. Steel with minimum thickness of 5/8-inch shall be used.
- b) Discharge trench cone scrapers shall be attached to and supported by the center driving shaft, so arranged as to scrape the settled solids within the center discharge cone.

### 4.8 Feed Well

- a) A steel flocculating feed well shall be provided, 8-feet in diameter by four feet deep, with split double entry feed pipe transition and/or center flow and feed device to assure positive dissipation of influent energy. Deep circular skirt design to reduce short circuiting of the feed across the upper region of the clarification will be acceptable. Mechanical rotating devices will not be acceptable.
- b) The flocculation feed well shall be of a proven and recognized design with successful installation referenced in similar applications.

### 4.9 Center Truss

- a) A steel truss type super structure shall be furnished. The superstructure will be of proper design to support the mechanism with mud load, Purchaser's walkway, feed launder and all normal operating loads.
- b) The superstructure will be supported on the tank side walls.

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4. Engineering Data (Continued)

4.10 Lifting Device

- a) Motorized lifting device shall be furnished to provide a simple and positive means of raising the rakes.
- b) Lifting device controls shall be provided to automatically raise, selected time basis.
- c) The Contractor shall also furnish, in conjunction with the lifting device, a mechanical lift indicator, visible from the platform, together with a locally mounted, weather proof electrical transmitter which will relay the position or "raise" of the rakes to two remote indicators and recorders in Purchaser's Water Treatment Building.
- d) The motorized lifting device shall be of the Contractor's standard proven design in similar flue dust thickener applications.
- e) The lifting mechanism shall be electrically operated using 460 volt, 3 phase, 60 Hertz motors. The unit control shall have the capability of overriding the time sequence operation in case an increase in torque dictates the raising of rakes during the normal scraping.
- f) When an overload condition exists, the rakes shall be automatically raised, held in the raised position for a selected period of time, then lowered again. If the overload still exists the rakes shall again be raised and stopped until they are manually lowered. Alarm interlocks shall be provided to indicate all overload conditions.
- g) Sequence timer shall be "Eagle Signal - Cycleflex" or approval equal.
- h) Preset time delay in raised position shall be accomplished through an electrical timer, 0-5 minutes. It shall be utilized in both the timed and overload raising cycles.
- i) An access platform and/or ladders shall be furnished for normal inspection and servicing of the lift mechanism.
- j) Interlocks shall be provided that the lifting mechanism cannot operate while blades are rotating and blades cannot rotate except in lowered position. Necessary limit switches in weather proof enclosures shall be furnished and mounted.

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#### 4. Engineering Data (Continued)

##### 4.11 Thickener Tank Trash Cover

The tank shall have a wire cloth trash cover and support system including but not limited to the following:

- a) One inch by one inch by 14 gauge galvanized and welded wire cloth in 48 inch width by 100 foot rolls. A sufficient number of rolls shall be furnished to totally cover the tank with an allowance made for overlapping edges at tie points.
- b) 16 gauge galvanized tie wire.
- c) Cable hanger rods shall be suspended from the thickener truss and from the truss above to cradle the support cables at the center of the thickener.

##### 4.12 Water Analysis

Total dissolved solids	3600 ppm
Alkalinity	800 ppm
Suspended solids	50 ppm
PH	7.5 to 8.5
Cyanide	8 ppm
Phenol	0.05 ppm
Iron	1 ppm
Zinc	0.35 ppm
Heavy Metals (Ph, Cd, Cu, Cr)	1 ppm each
Ammonia	50.0 ppm
Phosphorus	0.05 ppm
Calcium Hardness	1200 ppm

##### 4.13 Electrical

All electrical work shall meet the standards of the latest issue of the National Electrical Code and comply with Electrical Specification, A.C. Motors and Electrical Specification, A.C. Motors Control, Items 7 and 8 respectively enclosed herein.

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United States Steel Corporation  
Pittsburgh, Pennsylvania

SPECIFICATION NO. 535-6025-160  
ADDENDUM B

AUGUST 31, 1977

THICKENER MECHANISM  
GAS WASHER WATER RECYCLE FACILITIES  
GARY WORKS

The purpose of this addendum is as follows:

1. Increase the requirement of the thickener mechanism to accommodate a tank with an inside diameter of 65'-0" rather than 60'-0".
2. Obtain a further price proposal in the event the purchaser elects to purchase two (2) identical thickener mechanisms with appurtenances.

The following sheets have been amended and shall replace the like-numbers sheets in Specification No. 535-6025-160 dated October 8, 1976 or Specification No. 535-6025-160, Addendum "A", dated May 16, 1977.

Information Sheets,	pages 2 & 3
Questionnaire,	pages 1 thru 7
Proposal Form,	pages 1 & 2

Changes from the original specification by Addendum B are indicated by the symbol (B) in the left hand margin.

Bidder shall complete and return the attached Addendum B Questionnaire, updating sections as required to comply with the current specifications.

Bidder shall complete and return the attached Addendum B Proposal Form in its entirety.

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United States Steel Corporation  
Pittsburgh, Pennsylvania

#### 4. Engineering Data

##### 4.1 General

The water thickener mechanism will be installed by the Purchaser on a steel tank connected to concrete bottom.

##### (B) 4.2 Thickener Design Dimensions

- |    |                              |  |
|----|------------------------------|--|
| a. | Inside Tank Diameter         | 65 feet by 0 inches                          |
| b. | Depth of Straight Side Walls | 13 feet by 0 inches<br>(excluding freeboard) |

##### 4.3 Design Operation Conditions

The thickener equipment furnished under this Specification shall be designed to operate under the following conditions:

- (B)
- a. Influent consisting of blast furnace gas scrubber water at 3200 GPM normal, 4000 GPM maximum.
  - b. 26,000 ppm suspended solids influent consisting primarily of iron ore particles.
  - c. All particles shall be smaller than 100 mesh.
  - d. 40 ppm suspended solids effluent (a nonionic, high molecular weight polymer flocculant, Nalco 636 or equal, will be added at the centerwell of the thickener)

##### (A) 4.4 Thickener Mechanism

- a. Heavy duty thickener mechanism suitable for installation on the Purchaser's concrete foundation and Purchaser's steel tank designed for continuous operation of 150,000 foot pounds operating torque per standards of the American Gear Manufacturer's Association.
- b. The thickener mechanism shall include the following:
  - 1) A balanced type drive unit consisting of an approximate 60-inches diameter main spur gear of heat treated cast steel hardness, mounted on large diameter precision ball bearing.
  - 2) Two pinions of alloy steel.
  - 3) Two secondary spur gears of heat treated cast steel spur gear driven by a hardened steel worm.
  - 4) The worm is connected through enclosed roller chain and sprocket to a 3 phase, 60 hertz, 460 volt, TEFC motor.

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